

## SECTION 11361

### CIRCULAR CLARIFIER SLUDGE COLLECTION EQUIPMENT

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

###### A. Scope

1. Furnish and install two (2) center pier supported circular sludge collectors and appurtenances
2. Equipment to be installed in new, circular, concrete, final settling basins
3. Sludge collecting assemblies arranged to deliver sludge to center sludge wells for removal by pumping
  - a. One collection arm to be equipped with suction type collection header
  - b. Second collection arm to be equipped with scraper blades and squeegees
4. Equipment to include above water center drive, overload protection system, access bridge and walkway with perimeter handrails, center influent column, center feed well, sludge collector arm assemblies, torque tube or drive cage, flights, scum skimmer, scum box, scum baffle and appurtenances

###### B. Additional Requirements Specified Elsewhere

1. Section 01340: Shop Drawings and Product Data
2. Section 01400: Quality Control and Manufacturer's Field Services
3. Section 01600: Materials and Equipment
4. Section 01730: Operating and Maintenance Data

###### C. Related Requirements Specified Elsewhere

1. Section 03600: Grout
2. Section 05500: Metal Fabrications
3. Section 05501: Anchor Bolts and Drilled-In Anchors
4. Division 6: Woods and Plastics
5. Section 09900: Painting

##### 1.2 QUALITY ASSURANCE

###### A. Suppliers Qualifications

1. All equipment, materials, devices and appurtenances supplied by a single manufacturer or supplier
2. Experienced in manufacture of this equipment
3. Design Basis
  - a. Walker Process Equipment
  - b. Envirex, Inc.
  - c. Enviroquip, a Division of Eimco Water Technologies
  - d. WesTech Engineering, Inc.
  - e. Or equivalent

- f. Equivalent products of other manufacturers may be accepted subject to compliance with design, function, materials, and performance of the specified items

### 1.3 SUBMITTALS

#### A. Manufacturer's Literature and Illustrations

#### B. Manufacturer's Specifications and Illustrations

1. Sufficient data to verify compliance with specifications and to illustrate construction or assembly of the products
  - a. Sludge collectors
    - 1) Name of manufacturer
    - 2) Type and model
    - 3) Running torque developed
    - 4) Stalled torque
    - 5) AGMA torque rating
    - 6) Arm tip speed
    - 7) Flight dimensions and support requirements
    - 8) Bearing type and life calculations
  - b. Motors
    - 1) Name of manufacturer
    - 2) Type and model including class
    - 3) Rated size (hp)
    - 4) Temperature rating and service factor
    - 5) Weight
  - c. Gear reducers and drives
    - 1) Name of manufacturer
    - 2) Type and model
    - 3) Input and output speeds
    - 4) Exact gear ratios
    - 5) Service factor (24 hour continuous service)
2. Materials
3. Parts
4. Devices
5. Accessories
6. Dimensions
7. Net weight and design loads of all equipment and appurtenances including center of gravity and/or overturning moment of entire equipment package assembled in place
8. Tank floor construction and tolerance requirements
9. Electrical wiring diagrams
10. Control descriptions and diagrams
11. Shop painting
  - a. Detailed information on products, materials, surface preparation and application
  - b. Written certification from finish coating manufacturer of compatibility of shop applied primer and/or coating with field applied coatings

C. Shop Drawings

1. Fabrication
2. Assembly
3. Installation
4. Anchor bolt setting template

D. Certification of Compliance

1. Manufacturer's affidavit of compliance certifying
  - a. All tests have been performed
  - b. All equipment, materials and devices comply with these specifications with any exceptions noted
  - c. Equipment has been properly installed and is operating within specification tolerances

E. Operating and Maintenance Manuals in accordance with Section 01730

1.4 JOB CONDITIONS

A. Outdoor location exposed to all environmental and weather conditions

B. Site Elevation: 5410 feet above mean sea level

C. Secondary clarifier tanks to be constructed on drilled piers

1. Refer to previous Submittals paragraphs for design data submission requirements

D. Effluent from extended aeration activated sludge process reactors achieving

1. Carbon oxidation
2. Nitrification
3. Potential denitrification

E. Initial condition to operate one secondary clarifier

F. Design condition to operate two (2) secondary clarifiers in parallel

G. Design Flow Rates

1. Initial maximum month influent flow, not including return sludge flows: 0.75 MGD
2. Design maximum month influent flow per clarifier, not including return sludge flows: 1.25 MGD
3. Design peak hour influent flow per clarifier, not including return sludge flows: 2.31 MGD
4. Initial average sludge removal rate: 290 gpm
5. Design average sludge removal rate per clarifier: 480 gpm
6. Design maximum sludge removal rate per clarifier: 1,310 gpm

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE AND DESIGN REQUIREMENTS

#### A. Secondary Clarifiers

1. Number of units: Two (2)
2. Tank geometry: Circular
3. Tank inside diameter: 30 feet
4. Design side water depth: 13 feet
5. Design operating water surface elevation: 5407.30
6. Height of tank wall above operating water surface: 2.0 feet
7. Bottom slope: 1" in 12"
8. Center feed arrangement
9. Single peripheral effluent weir and launder trough

#### B. Sludge Collectors

1. Number of units per clarifier: One (1)
  - a. One suction header type arm
  - b. One scraper blade type arm
2. Minimum design running torque: 6,300 foot-pounds
3. Minimum AGMA torque rating: 12,600 foot-pounds
4. Maximum tip speed: 8 feet/min.
5. Rotation: Clockwise
6. Ball race diameter: 30 inches, minimum
7. Bridge design
  - a. Live load: 150 lbs/linear ft.
  - b. Dead load: As determined by manufacturer
  - c. Deflection: 1/360 of span
  - d. Supported from basin wall on one end and center pier on other end
8. No underwater bearings to carry vertical thrust load
9. Sludge collection arms: Arranged to traverse basin bottom twice per mechanism revolution

### 2.2 MATERIALS

#### A. Sludge Collection Mechanisms

1. Bridge assembly and drive platform
  - a. Steel: ASTM A36
  - b. Walkway: Aluminum I-bar grating, 1½" deep, minimum
  - c. Handrail: Minimum 1½" diameter schedule 40 aluminum pipe, mill finish
    - 1) Connectors: External mechanical connectors, SpeedRail® or equivalent
  - d. Toe plate: ¼" x 4" high, aluminum
2. Torque tube
  - a. Steel: ASTM A36
  - b. Schedule 80, minimum
  - c. Wall thickness: ¼" minimum

3. Drive cage
  - a. Steel: A36
  - b. Structural member: ¼" thickness, minimum
4. Scraper arms
  - a. Steel: ASTM A36
  - b. Triangular or box truss construction
    - 1) Truss construction: No tie rods
  - c. Structural members: ¼" thickness minimum
  - d. Scraper blades
    - 1) Steel flights
    - 2) Adjustable squeegees: Brass or stainless steel
5. Suction arms
  - a. Steel: A36
  - b. Thickness: ¼", minimum
  - c. Square or rectangular shaped, single header pipe
    - 1) Fully tapered for uniform sludge flow velocities throughout
    - 2) Circular pipe section not permitted
    - 3) Organ pipe type manifolds not permitted
  - d. Support system of stainless steel tie rod or truss rod construction
6. Influent feed well
  - a. Steel plate: A36
  - b. Thickness: 3/16", minimum
7. Effluent weirs and scum baffles
  - a. Fiberglass, aluminum or stainless steel
  - b. Refer to Drawing Details
8. Scum skimmer, trough, and blade ramp
  - a. Steel: ASTM A36
  - b. Skimmer and blade: Steel plate, ¼" minimum
    - 1) Wipers: Neoprene
  - c. Trough and ramp
    - 1) Fabricated steel plate, ¼" minimum
    - 2) Trough: 6" diameter steel pipe outlet
9. Anchor bolts and assembly hardware
  - a. Anchor bolts: Stainless steel
  - b. Structural fasteners: Stainless steel
  - c. General use: Stainless steel
  - d. Submerged service: Stainless steel

## 2.3 FABRICATION AND MANUFACTURE

### A. Bridge Assembly and Drive Platform

1. Half bridge construction
  - a. Steel beam supports for collector drive and access walkway extending across radius of tank
  - b. Supported by center pier on one end and tank wall on other end
  - c. Provide slide plates at tank wall
2. 3'-0" wide access walkway
  - a. Extend from drive platform to edge of concrete tank
  - b. Install level

3. Drive platform
  - a. Provide 3'-0" minimum clear access around equipment
4. Stairs
  - a. Provide at basin wall end of walkway as shown on the Drawings
  - b. Same width as walkway
  - c. Provide handrails each side of stairs
5. All welded structural steel construction with aluminum I-bar grating
6. Handrail posts and rails designed to meet IBC requirements
7. Handrail and toe plate furnished both sides of stairs and walkway and all around drive platform
8. Toe plate bolted to handrail
9. Live load: 150 lbs/linear foot
10. Maximum deflection 1/360 of span
11. Braced to assure rigidity

B. Torque Tube or Drive Cage, Scraper Arm and Suction Arm

1. Torque tube or drive cage bolted to drive unit
2. Two (2) arms attached to and rotated by torque tube or drive cage
  - a. One scraper arm
  - b. One suction arm
3. Sludge collection arms
  - a. Conform to slope of basin floor
  - b. Withstand full stalled torque of the drive unit
  - c. Provide counterweights as necessary to balance loads
4. Scraper blades
  - a. Connected to scraper arms
    - 1) Adjustable squeegees projecting 1½" below blades
    - 2) Move sludge radially to center sludge well
    - 3) Completely rake bottom of tank once per revolution
5. Suction arm
  - a. One piece, rigidly attached to center sludge outlet manifold
    - 1) Provide flanged connection between suction arm and center outlet manifold
    - 2) Hot dip galvanized after fabrication
  - b. Sized to ensure proper, uniform hydraulic flow throughout its length
    - 1) Cross sectional area to vary from maximum at tank center to minimum at tank perimeter
    - 2) Minimum velocity 0.5 fps at minimum sludge withdrawal rate
  - c. Tube sections positioned at 45° angle with tank bottom
    - 1) Leading edge of tube section to extend forward and down 2 inches at 45° angle
    - 2) Provide adjustable, flexible squeegee on leading edge of tube section
  - d. Aligned and supported by adjustable tie rods, truss rods or truss arm
  - e. Orifice openings
    - 1) Located in lower, leading edge of tube section
    - 2) Sized and positioned to ensure uniform sludge withdrawal over entire tank bottom
      - a) Size to vary
        - (1) Sized to withdraw sludge volumes proportional to respective coverage area

- (2) Minimum size: 2" diameter
  - b) Spaced at regular intervals along arm
    - (1) Maximum spacing: 30 inches
- f. Scraper blade
  - 1) To direct sludge from center of tank to first orifice
  - 2) Furnish with adjustable, flexible squeegee
- g. Center outlet manifold
  - 1) Attach to lower end of torque tube or drive cage
    - a) Provide effective sludge seal
  - 2) Rotates with suction arm
  - 3) Bottom to be open
    - a) Completely cover sludge withdrawal pipe opening
    - b) Provide full diameter seal ring and mounting plate assembly

#### C. Influent Feed Well

1. Located at center of tank
2. Sized to evenly distribute influent flow
  - a. Diameter: 12'-0"
  - b. Minimum submergence at design side water depth: 4'-6"
  - c. Projection above liquid: 3 inches, minimum
  - d. Maximum flow through velocity
    - 1) At design maximum month flow: 2.5 feet per minute
    - 2) At design peak hour flow: 6.0 feet per minute
3. Provide reinforcing angles as required to maintain shape and rigidity
4. Support from access bridge or drive cage
5. Fabricated with baffled scum port openings at water surface to direct floating material out of well

#### D. Scum Skimmer, Trough, and Blade Ramp

1. Collect floating scum in settling zone and flush into trough for removal
2. "Full surface" skimming equipment
3. Scum blade supported from torque tube, drive cage or scraper arm support system
  - a. Designs relying on scum baffle for support will not be acceptable
4. Hinged wiper assembly mounted on outer end of scum blade
  - a. Adjustable neoprene edges
  - b. Wearing strip
5. Hinged wiper assembly designed to form pocket for trapping scum
6. Continual contact and proper alignment between wiper blade, scum baffle and blade ramp as blade travels up the ramp
7. Wiper assembly supported at outer end for travel over scum trough
8. Rake scum up approach ramp and automatically discharge it into the trough
9. Approach ramp long enough for efficient scum removal
10. Ramp crest at same elevation as top of scum baffle
11. Scum trough
  - a. Width: 2'-6" minimum
  - b. Length: 4'-0" minimum
  - c. Attached to basin wall
  - d. 6" effluent pipe

12. Cam operated flush valve
  - a. Flush through with basin water at each pass of skimmer
  - b. Held shut with spring or weight
  - c. Time and duration of valve opening: Adjustable
  
- E. Effluent Weirs and Scum Baffles
  1. Refer to Drawings
  
- F. Drive Assemblies
  1. Design in accordance with the latest AGMA Standards
  2. Supported by bridge or center pier assembly
  3. Primary and final gear reduction unit as required
  4. Primary reduction unit
    - a. Helical or worm gear, heavy-duty speed reducer
    - b. Bearings
      - 1) Anti-friction type
      - 2) Immersed in oil in fully enclosed cast iron housing
    - c. Drive final reduction unit through chain and sprocket arrangement
      - 1) Self-lubricated roller chain
      - 2) OSHA approved removable chain guard
      - 3) Chain tension provided for by adjustable steel base mounted on intermediate reduction unit
  5. Intermediate reduction unit
    - a. Worm gear, heavy-duty speed reducer
    - b. Bearings
      - 1) Anti-friction type
      - 2) Grease or oil lubricated
      - 3) Cast iron or steel housing
    - c. Mounted on machined face at top of final reduction unit
      - 1) Properly aligned to maintain accurate centers for final reduction gearing
  6. Final reduction unit
    - a. Worm gear or pinion and internal gear enclosed in turntable base
      - 1) Ductile iron split gear for easy removal
    - b. Casting or turntable mounted on anti-friction ball bearing assembly
      - 1) Balls: High carbon, alloy steel
      - 2) Running on replaceable hardened alloy steel races
    - c. Bearing mounted in two piece housing of high strength cast iron
    - d. Torque tube or center cage supporting collection arms bolted to the gear housing
    - e. Final reduction gear and anti-friction ball bearings to run in oil bath within final gear reduction housing
    - f. Housing sealed against contaminants and contamination of water being treated
    - g. Oil filling and level pipe, drain plug and sight gauge to be provided
  7. Motor
    - a. 460V, 3-phase, 60 Hz
    - b. TEFC or TENV
    - c. NEMA Design B
    - d. Continuous duty



- e. 1.15 service factor minimum
  - 1) Maximum nameplate motor horsepower: 1.5 hp
- 8. Overload mechanism
  - a. Provide overload alarm system with visual torque load indicator
  - b. Alarm system to have two independent switches, located in a weatherproof housing of stainless steel or other corrosion resistant material
  - c. Alarm system setting
    - 1) High torque alarm contact closed above 120% of design running torque
    - 2) Shutdown torque alarm contact closed above 140% of design running torque
    - 3) Refer to controls paragraphs of this section
  - d. Torque overload contacts to be factory set
    - 1) Field adjustable over a range of 0 to 150%
  - e. Torque indicator activated by the worm shaft or by precise motor current measurement
    - 1) Indicator easily visible from walkway
    - 2) Scale: 0 to the AGMA torque rating of the equipment, minimum
    - 3) Units: Foot-pounds (ft-lbs)
    - 4) Provide adhesive indicators for the following values
      - a) Design running torque
      - b) High torque alarm
      - c) Shutdown torque alarm
      - d) Shear pin torque
      - e) AGMA design torque rating of the equipment
  - f. No shutdown or alarm on starting if current device used
  - g. Shear pin device
    - 1) Mechanical device designed to fail at 170% of design running torque

#### G. Anchor Bolts and Assembly Hardware

- 1. Manufacturer to indicate size, type, number required, etc.
  - a. Anchor bolts furnished by installation contractor
- 2. Of ample size and strength for the purpose intended
  - a. Minimum size
    - 1) Anchor bolts:  $\frac{3}{4}$ ", minimum per manufacturer
    - 2) Structural fasteners:  $\frac{1}{2}$ ", minimum per manufacturer
    - 3) Assembly hardware: As recommended by manufacturer
- 3. Manufacturer to furnish setting templates for all cast-in-place anchor bolts

## 2.4 SPARE PARTS

A. Manufacturer to furnish all recommended spare parts

B. The following spare parts are to be furnished, as a minimum

- 1. Two sets replacement sight glasses or oil gauges
- 2. One complete set squeegees for scraper arm blades
- 3. One complete set squeegees for suction arm collector
- 4. Two complete sets wearing strips and neoprene edges for scum blade wiper assembly
- 5. Two complete sets seals and bearings for each gear reduction unit

- a. Only one set required if gear reduction units on both clarifiers are identical

## 2.5 PAINTING AND COATINGS

- A. All surfaces to be painted or coated except
  - 1. Stainless steel
  - 2. Aluminum
  - 3. Galvanized
  - 4. Nickel or chromium
  - 5. Rubber and plastic
- B. All surfaces to receive prime, intermediate and/or finish painting or coating at the factory
- C. Surface Preparation
  - 1. Non-immersion service: Steel Structures Painting Council (SSPC) – SP6 Commercial Blast Cleaning
  - 2. Immersion service: Steel Structures Painting Council (SSPC) – SP10 Near White Blast Cleaning
- D. Painting or Coating System
  - 1. Manufacturer's standard coating system
    - a. In accordance with Section 09900
  - 2. Use only mercury-free, lead-free, fume-proof paint or coatings
  - 3. Paint or coatings must be suitable for atmosphere containing hydrogen sulfide
- E. Refer to Section 01600 for additional requirements

## 2.6 CONTROLS

- A. General
  - 1. All electrical work and equipment for the secondary clarifiers will be installed outdoors and exposed to the elements
  - 2. Provide corrosion and weather-resistant materials and construction as specified herein and shown on the Drawings
- B. Provide one control panel for the equipment of each secondary clarifier
- C. Control panels to be mounted next to stairs at the outside end of the bridge of each secondary clarifier
  - 1. Mount on galvanized unistrut
  - 2. Provide necessary clear space around panel to satisfy operational needs and code compliance
- D. Control Panel

1. Number required: 2, one for each secondary clarifier
2. Enclosure rating: NEMA 4
3. Control panel component rating: NEMA 4X
4. Completely prewired and factory tested prior to shipment
5. Main disconnect switch capable of being locked in the Off position
6. Accept input power of 480 VAC, 3-phase, 60 hertz
7. Include all logic devices, switches, relays, timers and other appurtenances for proper equipment operation and control
8. Include the following minimum electrical devices
  - a. FVNR motor starter and motor overload protection
  - b. Transformer for 120 VAC control system power
  - c. Main circuit breaker
9. Include the following minimum pilot and control devices
  - a. Hand/Off/Auto selector switch for equipment operation
    - 1) When in Hand, the equipment shall run continuously
    - 2) When in Auto, the equipment shall operate as follows
      - a) The equipment shall be energized and run given there are no motor overload or torque alarms
      - b) If the High Torque Alarm is activated, the equipment shall continue to be energized and run. The High Torque Alarm signal shall be sent to the plant's SCADA system
      - c) If the Shutdown Torque Alarm is activated, the equipment drive motor shall be de-energized to discontinue its run
      - d) The shear pin device is not required to have any electrical or control devices associated with it
  - b. Control power indicating light: White
  - c. Drive motor run indicating light: Green
  - d. High torque indicating light: Red
  - e. Emergency stop pushbutton
  - f. System reset pushbutton
  - g. Hour meter
  - h. Motor current monitor
  - i. Run output contact
  - j. General fault output contact (activate for any shutdown condition listed below)
10. Provide circuitry and devices to shutdown the equipment upon the following conditions
  - a. Motor overload/fault
  - b. Control panel emergency stop pushbutton activation
  - c. High Torque Alarm activation
11. Clearly label all front panel mounted items and devices on the outside front of the panel
12. Clearly label all wires and terminal points inside the control panel
13. All power and control wiring shall be 600 Volt, insulated copper and sized for the required load, 14 AWG minimum
14. All circuit breakers shall be thermal, magnetic, molded case units
15. All selector switches, pushbuttons and pilot lights shall be heavy-duty, water/oil tight, corrosion-resistant units rated for NEMA 4X service
16. All terminal blocks shall be pressure connector type with marking strips and covers suitable for copper connectors sized for the application
17. All control relays shall be industrial plug in type rated for the application load

## PART 3 - EXECUTION

### 3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01600 for requirements

### 3.2 INSTALLATION

#### A. Inspection

1. Inspect materials and equipment for signs of damage, pitting, rust, decay or other deleterious effects of storage, transportation, handling, etc.
  - a. Replace or repair any materials or equipment showing such effects to the satisfaction of the Engineer and Owner
  - b. Replace damaged materials or equipment with identical new materials or equipment

#### B. Equipment Installation

1. Handle, install, connect, clean, condition, align and adjust products and equipment in strict accordance with manufacturer's instructions and in conformity with specification requirements
  - a. Maintain one complete set of manufacturer's installation instructions at the jobsite during installation and until installation is accepted by the Engineer and Owner
  - b. Perform all work in accordance with manufacturer's instructions
    - 1) Do not omit any preparatory step or installation procedure unless specifically modified or exempted by contract documents
    - 2) Should job conditions or specification requirements conflict with manufacturer's instructions, consult with Engineer prior to proceeding
  - c. Accurately align, level and plumb all equipment, components and assemblies in strict accordance with manufacturer's instructions
  - d. Shimming between machined surfaced is not permitted
2. Provide lubricants as recommended by the manufacturer
  - a. Provide sufficient quantity to
    - 1) Fill all lubricant reservoirs
    - 2) Replace all lubricant consumed during testing, startup and operation prior to acceptance of equipment by Owner
3. Verify manufacturer's construction and tolerance requirements for the tank floors
  - a. Install grout floor to minimum depth of 2 inches as required by manufacturer
  - b. Place and finish grout floor in accordance with the manufacturer's instructions

#### C. Paint and Coatings

1. Recoat all shop coated surfaces damaged prior to product acceptance and to the satisfaction of the Engineer and Owner
  - a. Use paint and/or coating materials identical to those used by manufacturer for shop priming and painting

- b. Utilize surface preparation procedures as specified herein or as may be appropriate for repairs needed

D. Adjustment and Cleaning

1. Perform all required adjustments, tests, operational checks, cleaning and other startup activities required

### 3.3 FIELD TESTING

A. Ensure all bearings and gear reducers are properly lubricated

B. Make all necessary initial adjustments to put equipment into operation

C. Operational Testing

1. Operate equipment for minimum four (4) hours in dry tank, make any and all adjustments necessary until test is completed satisfactorily
2. Fill tank to design side water depth and repeat testing the same as for dry tank condition

D. Log drive motor amperages during all testing

E. Perform all other manufacturer's standard battery of tests

F. Equipment: No indication of binding, unusual loads, intermittent operation, or other problems

### 3.4 FIELD QUALITY CONTROL

A. Provide Manufacturer's Field Service

1. Minimum two trips to project site at minimum one-half ( $\frac{1}{2}$ ) day each
2. Qualifications of manufacturer's representative
  - a. Authorized representative of the manufacturer
  - b. Experienced in the application and installation of the subject work, materials and equipment
3. Services provided by representative
  - a. Provide guidance regarding proper installation
  - b. Supervise installation of equipment furnished under this section
  - c. Inspect, check, adjust and test equipment installed, as required, and approve final installation
  - d. Be present when equipment is placed in operation
  - e. Revisit site as often as required to correct all problems and until equipment installation and operation are acceptable to Engineer and Owner
4. Manufacturer's representative to instruct Owner's personnel in the operation and maintenance of the equipment furnished. Minimum one-half ( $\frac{1}{2}$ ) day including classroom and field training. May be combined with startup services

B. Furnish three (3) copies of written report to Engineer certifying that

1. Equipment is properly installed and lubricated
2. Equipment is in accurate alignment and balance
3. Equipment is free from any undue stress imposed by connecting piping, anchor bolts, etc.
4. Equipment has operated satisfactorily under full load conditions and as specified through full operating range

END OF SECTION